Attorney Docket No.: 108-151USAN10

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Continuation Application of:

| | | |
|---|---|---|
| Applicants | : | Constantine J. Tsikos; et al. |
| Application No. | : | 09/990,585 |
| Filing Date | : | November 21, 2001 |

Honorable Commissioner
of Patents and Trademarks
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above-referenced Patent Application, please amend the same as follows:

AMENDMENT OF THE TITLE TO INVENTION

Please amend the Title To Invention to read as follows:

--METHOD OF AND SYSTEM FOR PRODUCING HIGH-RESOLUTION 3-D IMAGES OF 3-D OBJECT SURFACES HAVING ARBITRARY SURFACE GEOMETRY--.

AMENDMENT OF THE SPECIFICATION:

Please amend the first paragraph of Page 1, entitled "Cross-Reference to Related U.S. Application" as follows:

This is a Continuation of copending Application No. 09/990,585 filed November 21, 2001 which is a Continuation-in-Part of: copending Application Serial No. 09/999,687 [09/---,--- [not yet assigned]] filed October 31, 2001 [[Attorney Docket 108-146USA000]]; copending Application Serial No. 09/954,477 filed September 17, 2001; [copending Application Serial No. 09/883,130 filed June 15, 2001, which is a Continuation-in-Part of Application Serial No. 09/781,665 filed February 12, 2001; copending Application Serial No. 09/780,027 filed February

9, 2001; ]copending Application Serial No. 09/721,885 filed November 24, 2000; [copending Application Serial No. 09/047, 146 filed March 24, 1998; copending Application Serial No. 09/157,778 filed September 21, 1998; copending Application Serial No. 09/274,265, filed March 22, 1999; International Application Serial No. PCT/US/99/06505 filed March 24, 1999, and published as WIPO WO 99/49411;] Application Serial No. 09/327,756 filed June 7, 1999; and International Application Serial No. PCT/US00/15624 filed June 7, 2000, published as WIPO WO 00/75856 A1; each said application being commonly owned by Assignee, Metrologic Instruments, Inc., of Blackwood, New Jersey, and incorporated herein by reference as if fully set forth herein in its entirety.

AMENDMENT OF THE CLAIMS TO INVENTION:

Please cancel Claims 1-669 and add new Claims 670-680 as follows:

--670. A system for producing high-resolution 3-D images of 3-D object surfaces of arbitrary surface geometry moving relative to said system, said system comprises:

an object profiling subsystem for profiling an 3-D object surface of arbitrary surface geometry moving past said system, and producing a series of linear 3-D surface profile maps of said moving 3-D object surface as said 3-D object surface moves past said system,

wherein each said linear 3-D surface profile map comprises a set of 3-D coordinates specifying the location of sampled points along said moving 3-D object surface;

a linear imaging subsystem for producing a series of linear high-resolution 2-D images of said moving 3-D object surface as said 3-D object surface moves past said system,

wherein each said linear high-resolution 3-D image comprises a set of pixel intensity values, and each said pixel intensity value being assigned a set of two-dimensional coordinates specifying the location of the pixel in said linear high-resolution 2-D image; and

an image processing computer for constructing high-resolution 3-D images of said 3-D object surface using said linear 3-D surface profile maps and said high-resolution 2-D linear images of said moving object surface.--

--671. The system of claim 670, wherein said image processing computer further comprises:

(i) means for producing a 3-D surface geometry model of said moving 3-D object surface using said linear 3-D surface profile maps,

(ii) means for mathematically projecting pixel rays from each pixel in each said captured linear high-resolution 2-D image,

(iii) means for computing the x, y, z coordinates associated with the points of intersection between these pixel rays and said 3-D surface geometry model, and

(iv) means for generating a linear high-resolution 3-D image of said moving 3-D object surface based on said computed points of intersection,

whereby each pixel in said high-resolution linear 3-D image comprises an intensity value I(x, y, z) and a set of x,y,z coordinate values specifying the location of the sampled point of said moving 3-D object surface; and

(v) assembling, in an image buffer, a set of consecutively computed linear high-resolution 3-D images so as to construct an area-type high-resolution 3-D image of said moving 3-D object surface.--

--672. The system of claim 671, wherein said image processing computer further comprises:

(vi) at the image processing computer, mapping the intensity value I(x', y', z') of each pixel in said computed area-type 3-D image onto the x',y',z' coordinates of points on a uniformly-spaced grid surface positioned along the optical axis of said linear imaging subsystem so as to model a 2-D planar substrate on which graphical forms of intelligence on said 3-D object surface might have been originally rendered; and

(vii) using an intensity weighing function based on the x', y', z' coordinate values of each pixel in said area-type high-resolution 3-D image, to produce an area-type high-resolution 2-D image of said 2-D planar substrate surface bearing said forms of graphical intelligence.--

--673. The system of claim 672, which further comprises:

(viii) at the image processing computer, using said OCR algorithm to perform automated recognition of graphical forms of intelligence that might be possibly contained in said area-type high-resolution 2-D image of said 2-D planar substrate surface so as to recognize said graphical forms of intelligence and generate symbolic knowledge structures representative thereof.--

--674. A method of producing high-resolution 3-D images of 3-D object surfaces of arbitrary surface geometry moving relative to said system, said method comprising the steps of:

(a) profiling a 3-D object surface of arbitrary surface geometry moving past an object profiling subsystem, and producing a series of linear 3-D surface profile maps of said moving 3-D object surface as said 3-D object surface moves past said subsystem,

wherein each said linear 3-D surface profile map comprises a set of 3-D coordinates specifying the location of sampled points along said moving 3-D object surface;

(b) producing a series of linear high-resolution 2-D images of said moving 3-D object surface as said 3-D object surface moves past a linear imaging subsystem,

wherein each said linear high-resolution 3-D image comprises a set of pixel intensity values, and each said pixel intensity value being assigned a set of two-dimensional coordinates specifying the location of the pixel in said linear high-resolution 2-D image; and

(c) constructing high-resolution 3-D images of said 3-D object surface using said linear 3-D surface profile maps and said high-resolution 2-D linear images of said moving object surface.--

--675. The method of claim 674, wherein step (c) further comprises:

(c1) producing a 3-D surface geometry model of said moving 3-D object surface using said linear 3-D surface profile maps,

(c2) means for mathematically projecting pixel rays from each pixel in each said captured linear high-resolution 2-D image,

(c3) means for computing the x, y, z coordinates associated with the points of intersection between these pixel rays and said 3-D surface geometry model, and

(c4) means for generating a linear high-resolution 3-D image of said moving 3-D object surface based on said computed points of intersection,

whereby each pixel in said high-resolution linear 3-D image comprises an intensity value I(x, y, z) and a set of x,y,z coordinate values specifying the location of the sampled point of said moving 3-D object surface; and

(c5) assembling, in an image buffer, a set of consecutively computed linear high-resolution 3-D images so as to construct an area-type high-resolution 3-D image of said moving 3-D object surface.--

--676. The method of claim 675, which further comprises:

(d) at the image processing computer, mapping the intensity value I(x', y', z') of each pixel in said computed area-type 3-D image onto the x',y',z' coordinates of points on a uniformly-spaced grid surface positioned along to the optical axis of said linear imaging subsystem so as to model a 2-D planar substrate on which graphical forms of intelligence on said 3-D object surface might have been originally rendered; and

(e) using an intensity weighing function based on the x', y', z' coordinate values of each pixel in said area-type high-resolution 3-D image, to produce an area-type high-resolution 2-D image of said 2-D planar substrate surface bearing said forms of graphical intelligence.--

--677. The method of claim 676, which further comprises:

(f) at the image processing computer, using said OCR algorithm to perform automated recognition of graphical forms of intelligence that might be possibly contained in said area-type high-resolution 2-D image of said 2-D planar substrate surface so as to recognize said graphical forms of intelligence and generate symbolic knowledge structures representative thereof.--

--678. A method of recognizing graphical intelligence recorded on planar substrates that have been physically distorted as a result of either (i) application of the graphical intelligence to an arbitrary 3-D object surface, or (ii) deformation of a 3-D object on which the graphical intelligence has been rendered.--

--679. The method of claim 678, which is capable of "undistorting" any distortions imparted to the graphical intelligence while being carried by the arbitrary 3-D object surface due to, for example, non-planar surface characteristics.--

--680. A method of recognizing graphical intelligence, originally formatted for application onto planar surfaces, but applied to non-planar surfaces or otherwise to substrates having surface characteristics which differ from the surface characteristics for which the graphical intelligence was originally designed without spatial distortion.--

REQUIREMENT UNDER 37 C.F.R. 1.121

As required under 37 C.F.R. 1.121, a clean version of the first paragraph of Page 1 is as follows:

This is a Continuation of copending Application No. 09/990,585 filed November 21, 2001 which is a Continuation-in-Part of: copending Application Serial No. 09/999,687 filed October 31, 2001; copending Application Serial No. 09/954,477 filed September 17, 2001; copending Application Serial No. 09/721,885 filed November 24, 2000; Application Serial No. 09/327,756 filed June 7, 1999; and International Application Serial No. PCT/US00/15624 filed June 7, 2000, published as WIPO WO 00/75856 A1; each said application being commonly owned by Assignee, Metrologic Instruments, Inc., of Blackwood, New Jersey, and incorporated herein by reference as if fully set forth herein in its entirety.

Also required under 37 C.F.R. 1.121, a clean set of the amended Claims is provided herebelow:

670. A system for producing high-resolution 3-D images of 3-D object surfaces of arbitrary surface geometry moving relative to said system, said system comprises:

an object profiling subsystem for profiling an 3-D object surface of arbitrary surface geometry moving past said system, and producing a series of linear 3-D surface profile maps of said moving 3-D object surface as said 3-D object surface moves past said system,

wherein each said linear 3-D surface profile map comprises a set of 3-D coordinates specifying the location of sampled points along said moving 3-D object surface;

a linear imaging subsystem for producing a series of linear high-resolution 2-D images of said moving 3-D object surface as said 3-D object surface moves past said system,

wherein each said linear high-resolution 3-D image comprises a set of pixel intensity values, and each said pixel intensity value being assigned a set of two-dimensional coordinates specifying the location of the pixel in said linear high-resolution 2-D image; and

an image processing computer for constructing high-resolution 3-D images of said 3-D object surface using said linear 3-D surface profile maps and said high-resolution 2-D linear images of said moving object surface.

671. The system of claim 670, wherein said image processing computer further comprises:

(i) means for producing a 3-D surface geometry model of said moving 3-D object surface using said linear 3-D surface profile maps,

(ii) means for mathematically projecting pixel rays from each pixel in each said captured linear high-resolution 2-D image,

(iii) means for computing the x, y, z coordinates associated with the points of intersection between these pixel rays and said 3-D surface geometry model, and

(iv) means for generating a linear high-resolution 3-D image of said moving 3-D object surface based on said computed points of intersection,

whereby each pixel in said high-resolution linear 3-D image comprises an intensity value I(x, y, z) and a set of x,y,z coordinate values specifying the location of the sampled point of said moving 3-D object surface; and

(v) assembling, in an image buffer, a set of consecutively computed linear high-resolution 3-D images so as to construct an area-type high-resolution 3-D image of said moving 3-D object surface.

672. The system of claim 671, wherein said image processing computer further comprises:

(vi) at the image processing computer, mapping the intensity value I(x', y', z') of each pixel in said computed area-type 3-D image onto the x',y',z' coordinates of points on a uniformly-spaced grid surface positioned along the optical axis of said linear imaging subsystem so as to model a 2-D planar substrate on which graphical forms of intelligence on said 3-D object surface might have been originally rendered; and

(vii) using an intensity weighing function based on the x', y', z' coordinate values of each pixel in said area-type high-resolution 3-D image, to produce an area-type high-resolution 2-D image of said 2-D planar substrate surface bearing said forms of graphical intelligence.

673. The system of claim 672, which further comprises:

(viii) at the image processing computer, using said OCR algorithm to perform automated recognition of graphical forms of intelligence that might be possibly contained in said area-type high-resolution 2-D image of said 2-D planar substrate surface so as to recognize said graphical forms of intelligence and generate symbolic knowledge structures representative thereof.

674. A method of producing high-resolution 3-D images of 3-D object surfaces of arbitrary surface geometry moving relative to said system, said method comprising the steps of:

(a) profiling a 3-D object surface of arbitrary surface geometry moving past an object profiling subsystem, and producing a series of linear 3-D surface profile maps of said moving 3-D object surface as said 3-D object surface moves past said subsystem,

wherein each said linear 3-D surface profile map comprises a set of 3-D coordinates specifying the location of sampled points along said moving 3-D object surface;

(b) producing a series of linear high-resolution 2-D images of said moving 3-D object surface as said 3-D object surface moves past a linear imaging subsystem,

wherein each said linear high-resolution 3-D image comprises a set of pixel intensity values, and each said pixel intensity value being assigned a set of two-dimensional coordinates specifying the location of the pixel in said linear high-resolution 2-D image; and

(c) constructing high-resolution 3-D images of said 3-D object surface using said linear 3-D surface profile maps and said high-resolution 2-D linear images of said moving object surface.

675. The method of claim 674, wherein step (c) further comprises:

(c1) producing a 3-D surface geometry model of said moving 3-D object surface using said linear 3-D surface profile maps,

(c2) means for mathematically projecting pixel rays from each pixel in each said captured linear high-resolution 2-D image,

(c3) means for computing the x, y, z coordinates associated with the points of intersection between these pixel rays and said 3-D surface geometry model, and

(c4) means for generating a linear high-resolution 3-D image of said moving 3-D object surface based on said computed points of intersection,

whereby each pixel in said high-resolution linear 3-D image comprises an intensity value I(x, y, z) and a set of x,y,z coordinate values specifying the location of the sampled point of said moving 3-D object surface; and

(c5) assembling, in an image buffer, a set of consecutively computed linear high-resolution 3-D images so as to construct an area-type high-resolution 3-D image of said moving 3-D object surface.

676. The method of claim 675, which further comprises:

(d) at the image processing computer, mapping the intensity value I(x', y', z') of each pixel in said computed area-type 3-D image onto the x',y',z' coordinates of points on a uniformly-spaced grid surface positioned along to the optical axis of said linear imaging subsystem so as to model a 2-D planar substrate on which graphical forms of intelligence on said 3-D object surface might have been originally rendered; and

(e) using an intensity weighing function based on the x', y', z' coordinate values of each pixel in said area-type high-resolution 3-D image, to produce an area-type high-resolution 2-D image of said 2-D planar substrate surface bearing said forms of graphical intelligence.

677. The method of claim 676, which further comprises:

(f) at the image processing computer, using said OCR algorithm to perform automated recognition of graphical forms of intelligence that might be possibly contained in said area-type high-resolution 2-D image of said 2-D planar substrate surface so as to recognize said graphical forms of intelligence and generate symbolic knowledge structures representative thereof.

678. A method of recognizing graphical intelligence recorded on planar substrates that have been physically distorted as a result of either (i) application of the graphical intelligence to an arbitrary 3-D object surface, or (ii) deformation of a 3-D object on which the graphical intelligence has been rendered.

679. The method of claim 678, which is capable of "undistorting" any distortions imparted to the graphical intelligence while being carried by the arbitrary 3-D object surface due to, for example, non-planar surface characteristics.

680. A method of recognizing graphical intelligence, originally formatted for application onto planar surfaces, but applied to non-planar surfaces or otherwise to substrates having surface characteristics which differ from the surface characteristics for which the graphical intelligence was originally designed without spatial distortion.

## REMARKS

The Commissioner is authorized to charge any fee deficiencies to Deposit Account No. 16-1340. A duplicate of this document is enclosed herewith.

Respectfully submitted,

Dated: February 7, 2002

Thomas J Perkowski, Esq.
Attorney for Applicants
Reg. No. 34,134
Thomas J. Perkowski, Esq., P.C.
Soundview Plaza
1266 East Main Street
Stamford, Connecticut 06902
203-357-1950
http://www.tjpatlaw.com

## CERTIFICATE OF EXPRESS MAIL UNDER 37 C.F.R. 1.10

I hereby certify that this correspondence is
being deposited with the United States Postal Service
on February 7, 2002
as Express Mail (No. EV024153686US)
in a postage prepaid envelope address to:

Commissioner of Patents and Trademarks
P.O. Box 2327
Arlington, VA 22202-3512

(alternative to the address set out in 37 C.F.R 1.1 and 37 C.F.R. 1.10;
Emergency Address for USPTO mail due to
November 16, 2001 suspension of "Express Mail" Service of USPS
for mail addressed to ZIP Codes 202xx through 205xx)

Mailer: Nancy Short
Dated: February 7, 2002